CHAPTER 12

OTHER RED ROCKFISH

by

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Relative to last years' final BSAI SAFE Report, the following changes have been made in the assessment of the Other Red Rockfish.

1) The 2001 landings have been revised and the 2002 landings through September 7, 2002 have been included in the assessment.

2) The 2002 Aleutian Islands survey biomass estimates were included in the assessment.

The recommended 2003 ABC levels relative to the 2002 recommendations, assuming identical species complexes as used in 2002, are as follows:

	Eastern Bering Sea		Aleutian Islands	
	2002	2003	2002	2003
Northern	19 t	18 t	6,745 t	6980 t
Rougheye/Shortraker	117 t	137 t	912 t	830 t

The recommended 2002 OFL levels relative to the 2001 recommendations, assuming identical species complexes as used in 2001, are as follows:

	Eastern Bering Sea/Aleutian Islands	
	2002	2003
Northern	9,019 t	9,332 t
Rougheye/Shortraker	1,372 t	1,289 t

INTRODUCTION

Pacific ocean perch (POP), and four other associated species of rockfish (northern rockfish, *S. polyspinis*; rougheye rockfish, *S. aleutianus*; shortraker rockfish, *S. borealis*; and sharpchin rockfish, *S. zacentrus*) were managed as a complex in the eastern Bering Sea (EBS) and Aleutian Island (AI) management areas from 1979 to 1990. Known as the POP complex, these five species were managed as a single entity with a single TAC (total allowable catch) within each management area. In 1991, the North Pacific Fishery Management Council enacted new regulations that changed the species composition of the POP complex. For the eastern Bering Sea slope region, the POP complex was divided into two subgroups: 1) Pacific ocean perch, and 2) shortraker, rougheye, sharpchin, and northern rockfishes combined, also known as "other red rockfish" (ORR). For the Aleutian Islands region, the POP complex was divided into three subgroups: 1) Pacific ocean perch, 2) shortraker/rougheye rockfishes, and 3) sharpchin/northern rockfishes. In 2001, the other red rockfish complex in the eastern Bering Sea was split into two groups, rougheye/shortraker and sharpchin/northern, matching the complexes used in the Aleutian Islands. Additionally, separate TACs were established for the EBS and AI management areas, but the overfishing level (OFL) pertains to the entire BSAI area. These subgroups were established to protect Pacific ocean perch, shortraker rockfish, and rougheye rockfish (the three most valuable commercial species in the assemblage) from possible overfishing. In 2002, sharpchin rockfish were assigned to the "other rockfish" category, leaving only northern rockfish and the shortraker/rougheye complex as member of other red rockfish.

The assessment methodology has differed for Pacific Ocean perch and other red rockfish. Pacific ocean perch has historically been the most abundant rockfish in this region and has contributed most to the commercial rockfish catch. Furthermore, the bulk of the research on rockfish has been concentrated on *S. alutus*; relatively little biological or assessment information is available for the other rockfish species. Thus, the Pacific ocean perch are assessed with an age-structured population model, whereas the other red rockfish are assessed with survey biomass estimates.

FISHERY

Catches of other red rockfish from the eastern Bering Sea and Aleutian Islands since 1993 are shown in Table 1. Examination of the official catch data by fishery reveals that much of the catch of northern rockfish in the Aleutian Islands is bycatch in the Atka mackerel fishery and is discarded, accounting for the high discard rates seen in Table 2.

Estimates of catch, by species, from 1977 to 2002 are shown in Tables 3-5. Catches from the 1977-1989 foreign and joint venture fisheries were produced by computing the harvest proportions within management groups from the North Pacific Foreign Observer Program database, and applying these proportions to the estimated total catch. An identical procedure, using the North Pacific Domestic Observer Program database, was used to produce the domestic catches from 1991-2002, using the total catch estimates summarized by the NMFS Alaska regional office. Catches from the domestic fishery prior to the domestic observer program were obtained from PACFIN records. Estimated domestic catches in 1990 were obtained from Guttormsen et al. 1992. Estimates of species-specific catch in 2002 were based on observer records through September 16, 2002, and estimated total catch through September 7, 2002. The largest catches in the northern rockfish time

series have occurred since 1993 (Table 3). Catches of shortraker and rougheye rockfish appear low in the mid-1980's, when the foreign fishery was reduced (Tables 4 and 5).

Estimates of catch by species can be compared to potential single-species ABC and OFL levels in order to evaluate whether excessive harvests may have occurred in the past (Tables 6 and 7). Beginning in 2001, the OFL levels for other red rockfish pertain to the entire BSAI area. Thus, the retrospective analysis of what single-species harvest limits might have been in these years is shown separately in Table 6, whereas years 1994 to 2000 is shown in Tables 7 and 8. The intent of this analysis is to investigate how our estimates of catch compare with what would have been recommended under single-species management. The catch of other red rockfish in the Aleutian Islands is dominated by northern rockfish, and the estimated harvest in recent years has ranged from 1,997 t to 6637 t (Tables 6 and 7). Although northern rockfish catch in the EBS management area exceeded the EBS ABC of 19 t in 2001 and 2002, the BSAI catch of northern rockfish is below the potential BSAI OFL levels (Table 6). However, the estimated 2001 BSAI rougheye rockfish catch of 615 t would have exceeded the BSAI OFI (350 t), if other red rockfish were managed as single-species assessments.

Prior to 2001, the rougheye/shortraker group in the Aleutian Islands was composed primarily of rougheye rockfish, whose proportion of the group has varied from 0.49 to 0.92 in recent years. Note that observers can report shortraker and rougheye rockfish by species, or as a combined shortraker/rougheye species group. The combined group could not be used for estimating proportions, however, it has accounted for a large percentage of all shortraker and rougheye observer reports in recent years. For example, approximately 25% of the 330 t of Aleutian Islands shortraker and rougheye rockfish observed in 2000 were assigned to this combined code.

Northern rockfish and shortraker rockfish have been the largest components of the eastern Bering Sea other red rockfish harvest from 1995 to 2000, as these two species ranged from 79% to 96% of the other red rockfish (Table 8). Often the estimated catches of these two species are similar, but because the population size of northern rockfish in recent assessments is estimated to be considerably smaller than shortraker rockfish (based upon average biomass of the post-1986 NMFS surveys), the northern rockfish have smaller harvest ABC levels.

The utility of the estimated catch by species is dependent on sampling a reasonable portion of the total catch for species composition. In the Aleutian Islands, the proportion of the total catch, by management group, sampled by observers and identified to species was above 50% from 1994 to 2001, but is less than 10% for shortraker/rougheye in 2002. In the eastern Bering Sea, the sampling ratios were above 40% from 1994 to 2000 (except 1997), but were approximately 30% for the available 2002 data on the two management groups.

Application of the observed ratio of rougheyes to shortrakers to the total catch estimate of the rougheye/shortraker complex assumes that the observed fish are a representative sample of the unobserved fish. However, observers on longliners may be identifying a greater proportion of rougheye rockfish to species than shortraker rockfish (Dan Ito, personal communication, Alaska Fisheries Science Center, Seattle, WA). In 2003, the North Pacific Observer Program with undertake changes to improve estimation of shortraker and rougheye in order to obtain representative species compositions, including making species identifications from basket sample where a detailed examination can occur.

The potential overfishing of a single member of the other red rockfish complex motivated the identification of locations, target fisheries, and gears contributing to rougheye rockfish harvests. These descriptive variables were obtained for each BSAI haul in the observer database that caught rockfish from 1994 to 2001. A target fishery, defined as the species group with the largest catch,

was assigned based on the species composition in the haul. For species groups with more than one species, such as rockfish, the target was further defined as the species within the group with the greatest catch. Note that this definition of targeting is based on the total catch, and does not consider discarding. The top ten combinations, per year, of target fishery, gear, and management area that contributed to observed rougheye rockfish catch from 1998 to 2001 is shown in Table 9. Whereas the observed POP fishery in the central and western Aleutians (areas 542 and 543) generally catch a large proportion of rougheye rockfish, large catches of rougheye in 2001 were attributed to bottom trawls in the eastern Aleutians (area 541) that had rougheye rockfish as the largest rockfish group. A more detailed examination revealed that this group consisted of three hauls near Tanaga Island on July 7th; two of these hauls caught a large amount of POP and/or Atka mackerel, which may represent a true "target" species.

DATA

This section describes data used in the current assessment. It does not attempt to summarize all available data pertaining to other red rockfish in the BSAI.

Absolute Abundance

Biomass estimates for other red rockfish were produced from cooperative U.S.-Japan trawl survey from 1979-1985 on the eastern Bering Sea slope, and from 1980-1986 in the Aleutian Islands. U.S domestic trawl surveys were conducted in 1988, 1991, and 2002 on the eastern Bering Sea slope, and in 1991,1994, 1997, 2000, and 2002 in the Aleutian Islands (Table 10). The 2002 eastern Bering Sea slope survey represents the initiation of a new survey time series distinct from the previous surveys in 1988 and 1991. The biomass estimate for the eastern Bering Sea has two surveyed components—the eastern Bering Sea slope component and the portion of the Aleutian Islands survey in the eastern Bering Sea management region.

Other red rockfish are currently managed under Tier 5 of Amendment 56 to the BSAI groundfish management plan, and thus rely solely on survey biomass estimates for information on population size. Because of the high CVs of recent estimates, we thought it prudent to take an average of the survey biomass estimates to arrive at a recent biomass for each species in each region. The years used in the averaging were 1991-2002 for the Aleutian Islands survey, and 1988, 1991, and 2002 for the EBS slope survey. The average of the 1991-2002 data for the southern Bering Sea portion of the Aleutian Islands survey was added to the average of the EBS slope survey estimates to obtain a total EBS average. The Aleutian Islands biomass estimates were obtained by averaging the 1991-2002 data for the portion of the AI survey with the AI management area. In addition, we excluded the data from the cooperative U.S.-Japan trawl surveys (1979-86) from the averages, because these surveys were conducted with considerably different vessels and gear than the U.S. domestic trawl surveys (1988-2002) (Skip Zenger, National Marine Fisheries Service, Seattle, WA, personal communication). Using this approach we estimate the current biomass of northern, rougheye, and shortraker rockfish as follows:

	Eastern Bering Sea	Aleutian Islands
Northern rockfish	409 t	155,108 t
Rougheye rockfish	1,721 t	11,480 t
Shortraker rockfish	4,640 t	27,317 t

Clearly, as new surveys are conducted the averaging of all survey biomass estimates cannot continue indefinitely in future assessments, as this would eventually involve using old biomass estimates. One approach is to use the most recent three survey estimates, as in the GOA slope rockfish assessment (Heifetz et al. 2001). However, when applied to the EBS slope survey, this would involve the same three survey years of 1988, 1991, and 2002. Biomass estimates that use only the 1997, 2000, and 2002 Aleutian Islands surveys were considered and presented below for comparison:

	Eastern Bering Sea	Aleutian Islands
Northern rockfish	194 t	156,145 t
Rougheye rockfish	1,726 t	11,201 t
Shortraker rockfish	4,469 t	29,525 t

The biomass estimates are similar to those obtained from using all of the post-1991 AI survey data, with the exception of EBS northern rockfish. Because the EBS survey data used extend back to 1988, it is felt the most consistent procedure would be to use the AI survey data since 1991. Averaging of only the most recent estimates, or taking a weighted average, is expected to occur in future assessments as the time series of EBS slope survey estimates develops.

Parameters Estimated Independently

Estimates of *M* and maximum age were obtained from Heifetz and Clausen (1991):

	M	Max Age Range
Northern rockfish	0.060	49-57
Rougheye rockfish	0.025	95-140
Shortraker rockfish	0.030	120

The estimates of *M* for rougheye and shortraker rockfish were obtained from catch curve analysis, whereas estimates of northern rockfish *M*, and maximum age, were obtained by Alverson-Carney method (Alverson and Carney 1975). Estimates of maximum age for rougheye and shortraker rockfish were obtained from Archibald et al. 1981, Chilton and Beamish 1982, Nelson and Quinn 1987, and Nelson 1986.

PROJECTIONS AND HARVEST ALTERNATIVES

Reference Fishing Mortality Rates and Yields

Reference fishing mortality rates are based upon estimates of natural mortality, where F_{abc} is defined as 75% of M . The acceptable biological catch is obtained by multiplying F_{abc} by the estimated biomass. This procedure results in the following ABCs:

	EBS	Aleutian Islands
Northern rockfish	18 t	6,980 t
Rougheye rockfish	32 t	215 t
Shortraker rockfish	104 t	615 t

The overfishing mortality level for the other rockfish species was calculated as $F_{OFL} = M$, and are summarized by region below:

	EBS	Aleutian Islands
Northern rockfish	25 t	9,307 t
Rougheye rockfish	43 t	287 t
Shortraker rockfish	139 t	820 t

Given the large CVs of the survey biomass estimates, it is reasonable to ask what the recommended harvest rates would be under the guidelines of tier 6 of Amendment 56 to the BSAI groundfish management plan. Under tier 6, ABC is set to 0.75 times the average catch from 1978-1995. The average catches can be obtained from tables 3-6, giving the following Aleutian Islands ABC values under tier 6:

Species	AI average catch (1978-1995)	ABC
Northern	1042	782
Rougheye	431	324
Shortraker	203	152

Thus, under tier 6 the AI northern rockfish and shortraker rockfish ABCs are reduced dramatically relative to tier 5, whereas the rougheye rockfish ABC is increased. The eastern Bering Sea ABC and values under tier 6 are:

Species	EBS average catch (1978-1995)	ABC
Northern	161	121
Rougheye	130	98
Shortraker	164	123

Thus, under tier 6 the ABC for all three species are increased relative to their values under tier 5. It is recommended that other red rockfish remain in the tier 5 category, in part because the average catches from 1978-1995 does not reflect recent catches for some species, particularly northern

rockfish. However, future research should continue to investigate survey methodologies that could reduce the variances of biomass estimates.

A potential problem with assigning a harvest quota to complexes of two or more species is that members of the complex may experience disproportionate harvest rates while the group harvest quota is not exceeded. Historically, the estimated tier 5 harvest of rougheye rockfish has occasionally exceeded their potential single-species harvest limits, sometimes by large amounts. For example, the estimated catch in 1996 was 850 t, as compared with potential OFL level of 587 t, respectively (Table 7). There is some uncertainty in this estimate because observers commonly used the shortraker / rougheye combined identification code. However, even if all the observed fish coded as "shortraker/rougheye" in 2001 were shortrakers, the estimated total catch of rougheye will still have exceeded the potential single-species rougheye OFL.

In the 2000 and 2001 SAFEs, the BSAI Plan Team recommended that a single BSAI-wide ABC be applied for each species of other red rockfish, partitioned by management area in proportion to recent survey biomass estimates. This recommendation was supported by preliminary data indicating that northern rockfish separated by large distances in the north Pacific did not show heterogeneity in mtDNA or microsatellite DNA (Tony Gharrett, University of Alaska, pers. comm.), although the samples sizes were small and these results do not necessarily imply lack of population structure. Additionally, the bulk of EBS northern rockfish harvest appears to occur in the southern Bering Sea area rather than the EBS slope, and thus is close to Aleutian Islands management area. Although the North Pacific Fishery Management Council adopted this recommendation, its implementation was hindered by the large amount of shortraker and rougheye rockfish not identified to species by fishery observers on longline vessels. In 2003, the observer program will implement a number of changes aimed at increasing identification of shortraker and rougheye rockfish on longline vessels.

Based on concerns regarding disproportionate harvest rates and spatial concentration of catch, it is recommended that shortraker/rougheye be treated as a complex in 2003, with the expectation that improvements in species identification will allow single-species ABCs in the future. The recommended ABC and OFL levels are:

	EBS ABC	AI ABC	BSAI OFL
Northern	18 t	6,980 t	9,332t
Rougheye/Shortraker	137 t	830 t	1,289 t

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Table 1. Estimated removals (t) of other red rockfish (the sum of northern rockfish, sharpchin rockfish, shortraker rockfish, and rougheye rockfish), the sharpchin/northern (SCNO), shortraker/rougheye (SRRE) complexes, and northern rockfish from the eastern Bering Sea and Aleutian Islands regions. Prior to 2001, harvests in the eastern Bering Sea were managed with the ORR complex. Beginning in 2002, sharpchin rockfish were removed from other red rockfish and northern rockfish were managed with single-species catch levels. Unless otherwise noted, catch data were obtained from summaries produced by the NMFS Alaska regional office.

	Eastern Bering Sea				Aleutian Islands		
Year	ORR	SCNO	Northerns	SRRE	SCNO	Northerns	SRRE
1993	1226**				4,486		1,130
1994	129				4,667		925
1995	343				3,873		559
1996	207				6,653		959
1997	230				1,997		1,043
1998	97				3,674		661
1999	227				5,255		485
2000	245				4,737		443
2001		153		42	5,978		704
2002*			96	91		1986	460

*Estimated removals through September 7, 2002

**Source: Blend catch estimates.

Table 2. Estimated retained, discarded, and percent discarded of other red rockfish (ORR), sharpchin/northern (SC/NR), and shortraker/rougheye (SR/RE) from the eastern Bering Sea (EBS) and Aleutian Islands (AI) regions. Prior to 2001, ORR in the eastern Bering Sea were managed as a single complex. Beginning in 2002, sharpchin rockfish were removed from other red rockfish and northern rockfish were managed with single-species catch levels. Unless otherwise noted, catch data were obtained from summaries produced by the NMFS Alaska regional office.

Species Area	Group	Year	Catch Retained	Discard	Total	Percentage
EBS	ORR	1993**	916	310	1226	25.2%
		1994	28	101	129	78.3%
		1995	273	71	344	20.6%
		1996	58	149	207	72.0%
		1997	57	173	230	75.2%
		1998	41	71	112	63.4%
		1999	67	161	228	70.6%
		2000	107	139	246	56.5%
EBS	SC/NO	2001	15	138	153	90.2%
EBS	RE/SR	2001	26	16	42	38.1%
EBS	Northerns	2002*	5	90	95	94.7%
EBS	RE/SR	2002*	45	45	90	50.0%
AI	SC/NO	1993	320	4,166	4,486	92.9%
		1994	798	3,870	4,668	82.9%
		1995	1,207	2,665	3,872	68.8%
		1996	2,269	4,384	6,653	65.9%
		1997	145	1,852	1,997	92.7%
		1998	459	3,289	3,748	87.8%
		1999	521	4,735	5,256	90.0%
		2000	273	4,464	4,737	94.2%
		2001	171	5,807	5,978	97.1%
AI	Northerns	2002*	75	1911	1986	96.2%
AI	SR/RE	1993	733	397	1,130	35.1%
		1994	700	224	924	24.2%
		1995	455	103	558	18.5%
		1996	752	208	960	21.7%
		1997	732	310	1,042	29.8%
		1998	449	235	684	34.4%
		1999	293	191	484	39.5%

Table 2, continued.

Species Area	Group	Year	Catch Retained	Discard	Total	Percentage
AI	SR/RE	2000	258	183	441	41.5%
		2001	457	246	703	35.0%
		2002*	236	124	460	26.9%

* Estimated removals through September 7, 2002.
**Source: Blend catch estimates.

Table 3. Catches of northern rockfish in the BSAI area, obtained from the North Pacific Groundfish Observer Program, NMFS Alaska Regional Office, and PACFIN. Aleutian Islands domestic catch for 1991 was not used because of a discrepancy between observed and estimated total catch.

	Eastern Bering Sea			Aleutian Islands			
Year	Foreign	Joint Venture	Domestic	Foreign	Joint Venture	Domestic	Total
1977	4			3,232			3,236
1978	21			549			570
1979	61			195			256
1980	49	9		221			279
1981	20	0		92			112
1982	63	8		177	0		248
1983	10	32		47	0		89
1984	26	6		11	185		229
1985	5	1		0	189		195
1986	5	41	15	0	193	15	270
1987	1	45	31		248	60	385
1988		4	36		438	55	534
1989		12	66		0	306	384
1990			247			1,235	1,481
1991			455				455
1992			328			1,541	1,868
1993			959			4,480	5,440
1994			47			4,666	4,712
1995			286			3,858	4,144
1996			116			6,637	6,753
1997			118			1,997	2,114
1998			47			3,674	3,721
1999			144			5,254	5,399
2000			114			4,737	4,851
2001			153			5,978	6,131
2002*			96			1,986	2,082

* Estimated removals through September 7, 2002.

Table 4. Catches of shortraker rockfish in the BSAI area, obtained from the North Pacific Groundfish Observer Program, NMFS Alaska Regional Office, and PACFIN. Aleutian Islands domestic catch for 1991 was not used because of a discrepancy between observed and estimated total catch.

	Eastern Bering Sea			Aleutian Islands			
Year	Foreign	Joint Venture	Domestic	Foreign	Joint Venture	Domestic	Total
1977	0			26			27
1978	713			131			844
1979	372			977			1,349
1980	380	0		74			455
1981	258	0		315			573
1982	242	0		379	0		621
1983	145	0		89	1		235
1984	54	0		28	0		83
1985	19	0		1	0		21
1986	2	2	14	0	0	12	30
1987	0	0	28		0	36	64
1988		0	31		0	37	69
1989		0	58		0	130	188
1990			116			546	662
1991			157				157
1992			72			292	364
1993			184			257	440
1994			55			174	230
1995			43			178	222
1996			68			109	177
1997			79			85	164
1998			39			137	176
1999			69			102	171
2000			112			187	300
2001			32			89	121
2002*			90			234	324

* Estimated removals through September 7, 2002.

Table 5. Catches of rougheye rockfish in the BSAI area, obtained from the North Pacific Groundfish Observer Program, NMFS Alaska Regional Office, and PACFIN. Aleutian Islands domestic catch for 1991 was not used because of a discrepancy between observed and estimated total catch.

	Eastern Bering Sea			Aleutian Islands			
Year	Foreign	Joint Venture	Domestic	Foreign	Joint Venture	Domestic	Total
1977	1			153			155
1978	66			364			430
1979	637			999			1,636
1980	94	0		265			359
1981	166	0		493			658
1982	124	0		189	0		312
1983	53	0		56	2		111
1984	79	0		31	4		114
1985	18	0		1	9		27
1986	3	1	48	0	2	19	74
1987	1	2	96		3	76	179
1988		1	110		5	70	185
1989		2	202		0	381	585
1990			369			1,619	1,988
1991			83				83
1992			65			1,174	1,239
1993			82			873	956
1994			27			751	778
1995			13			381	394
1996			23			850	873
1997			33			958	991
1998			11			524	535
1999			10			383	393
2000			18			256	274
2001			10			615	625
2002*			1			226	227

* Estimated removals through September 7, 2002.

Table 6. Catch of other red rockfish in the Aleutian Islands from 2001 to 2002, with reported species ABC and OFL levels. In 2002, sharpchin rockfish were dropped from the other red rockfish group. The SR/RE species code includes both shortraker and rougheye rockfish.

		Aleutian Islands			Eastern Bering Sea			
	Species	Observed Catch	Total Catch	ABC	Observed Catch	Total Catch	ABC	BSAI OFL
2002*	Northern	1543.96	1986.00	6745	30.20	96.00	19	9019
	Rougheye	16.97	226.37	230	0.38	1.40	32	350
	Shortraker	17.52	233.63	682	24.14	89.60	84	1021
	SR/RE	22.63			1.88			
2001	Northern	5035.24	5977.96	6745	127.07	152.96	19	9019
	Sharpchin	0.04	0.04		0.03	0.04		
	Rougheye	362.59	614.67	230	6.53	9.63	32	350
	Shortraker	52.69	89.33	682	21.95	32.37	84	1021
	SR/RE	68.47			9.38			

* Observer data through September 16, 2002; total catch estimate through September 7, 2002

Table 7. Catch of other red rockfish in the Aleutian Islands from 1994 to 2000, with potential single-species ABC and OFL levels. The SR/RE species code includes both shortraker and rougheye rockfish.

	Species	Observed Catch	Proportion of Sp. Group	Estimated total catch	ABC	OFL
2000	Northern	3995.77	1.0000	4736.85	5153	6870
	Sharpchin	0.13	0.0000	0.15		
	Rougheye	141.91	0.5768	255.54	239	319
	Shortraker	104.11	0.4232	187.46	646	861
	SR/RE	83.77				
1999	Northern	4423.65	0.9998	5254.21	4230	5639
	Sharpchin	0.67	0.0002	0.79		
	Rougheye	285.04	0.7893	382.82	405	540
	Shortraker	76.08	0.2107	102.18	560	747
	SR/RE	39.28				
1998	Northern	2896.60	0.9999	3673.61	4230	5639
	Sharpchin	0.30	0.0001	0.39		
	Rougheye	347.62	0.7926	523.90	405	540
	Shortraker	90.97	0.2074	137.10	560	747
	SR/RE	73.48				
1997	Northern	1426.29	0.9999	1996.76	4358	5810
	Sharpchin	0.17	0.0001	0.24		
	Rougheye	723.73	0.9185	957.99	440	587
	Shortraker	64.23	0.0815	85.01	498	664
	SR/RE	6.49				
1996	Northern	4540.15	0.9975	6636.64	5810	5810
	Sharpchin	11.19	0.0025	16.36		
	Rougheye	519.52	0.8866	850.27	587	587
	Shortraker	66.44	0.1134	108.73	664	664
	SR/RE	8.79				
1995	Northern	2376.14	0.9961	3857.93	5670	5670
	Sharpchin	9.28	0.0039	15.07		
	Rougheye	195.61	0.6808	380.56	632	632
	Shortraker	91.72	0.3192	178.44	590	590
	SR/RE	1.58				
1994	Northern	3223.12	0.9997	4665.68	5670	5670
	Sharpchin	0.91	0.0003	1.32		
	Rougheye	465.96	0.8116	750.71	632	632
	Shortraker	108.18	0.1884	174.29	590	590
	SR/RE	0.79				

Table 8. Catch of other red rockfish in the eastern Bering Sea from 1994 to 2000, with potential single-species ABC and OFL levels. The SR/RE species code includes both shortraker and rougheye rockfish.

	Species	Observed Catch	Proportion of Sp. Group	Estimated total catch	ABC	OFL
2000	Northern	64.14	0.4647	113.86	34	45
	Sharpchin	0.11	0.0008	0.19		
	Rougheye	10.55	0.0764	18.72	35	47
	Shortraker	63.23	0.4581	112.23	125	167
	SR/RE	15.95				
1999	Northern	86.84	0.6353	144.22	537	716
	Sharpchin	1.83	0.0134	3.04		
	Rougheye	6.46	0.0473	10.73	51	68
	Shortraker	41.56	0.3040	69.02	185	247
	SR/RE	5.05				
1998	Northern	28.77	0.4841	46.96	537	716
	Sharpchin	0.05	0.0009	0.09		
	Rougheye	6.91	0.1163	11.28	51	68
	Shortraker	23.69	0.3987	38.67	185	247
	SR/RE	8.55				
1997	Northern	24.95	0.5107	117.46	788	1051
	Sharpchin	0.12	0.0025	0.58		
	Rougheye	6.97	0.1426	32.80	56	75
	Shortraker	16.81	0.3442	79.15	207	276
	SR/RE	4.66				
1996	Northern	61.27	0.5606	116.04	1051	1051
	Sharpchin	0.01	0.0001	0.01		
	Rougheye	12.05	0.1103	22.82	75	75
	Shortraker	35.97	0.3291	68.13	276	276
	SR/RE	0.93				
1995	Northern	159.10	0.8352	286.48	1051	1051
	Sharpchin	0.00	0.0000	0.00		
	Rougheye	7.33	0.0385	13.20	75	75
	Shortraker	24.05	0.1263	43.31	276	276
	SR/RE	0.93				
1994	Northern	20.08	0.3617	46.66	1051	1051
	Sharpchin	0.02	0.0004	0.05		
	Rougheye	11.63	0.2095	27.02	75	75
	Shortraker	23.79	0.4285	55.27	276	276
	SR/RE	0.00				

Table 9. Observed catch (t), per year, of BSAI rougheye rockfish from the top ten combinations of fishery, area, and gear from 1998-2001.

			Year			
Target	Area	Gear	1998	1999	2000	2001
Rougheye	541	Bottom trawl		79.56		154.17
Rougheye	542	Longline			2.65	
POP	541	Bottom trawl	37.35	19.95	17.56	42.31
POP	542	Bottom trawl	63.81	67.04	25.77	43.75
POP	543	Bottom trawl	81.82	65.82	50.61	67.12
Pacific cod	518	Longline			2.77	
Pacific cod	541	Longline	34.48	3.58	3.43	2.24
Pacific cod	542	Longline	46.04	22.55	23.49	12.16
Pacific cod	543	Longline			3.38	19.49
Other fish	542	Bottom trawl	1.68			
Other fish	542	Longline		1.27		
Northern	543	Bottom trawl	3.25	3.97		
Greenland turbot	517	Bottom trawl			2.22	
Atka mackerel	541	Bottom trawl	49.77			6.81
Atka mackerel	542	Bottom trawl	17.61	11.27	7.59	3.76
Atka mackerel	543	Bottom trawl	7.42	5.10		5.62
Total (top ten combinations)			343.23	280.13	139.47	357.43
Total Observed Catch			354.53	291.50	152.46	369.12
Total Estimated Catch			535.18	393.55	274.26	624.30

Table 10. Estimated biomass (t) of rougheye, shortraker, and northern rockfishes from the NMFS bottom trawl surveys. For the Aleutian Islands surveys since 1991 and the eastern Bering Sea surveys since 1988, the coefficient of variation (CV) is shown in parentheses.

Eastern Bering Sea (EBS) Surveys

	Rougheye		Shortraker		Northern	
1979	1,053		1,391		53	
1981	816		3,571		23	
1982	605		5,176		24	
1985	1,716		4,010		--	
1988	876	(0.32)	1,260	(0.43)	4	
1991	884	(0.30)	5,154	(0.38)	--	
2002	565	(0.21)	1,463	(0.46)	33	(0.38)

Aleutian Islands portion of EBS Area I

	Rougheye		Shortraker		Northern	
1980	922		1,020		341	
1983	2,830		13,079		1,516	
1986	3,511		6,478		67,394	
1991	676	(0.12)	1,925	(0.66)	582	(0.63)
1994	1,208	(0.49)	1,959	(0.78)	855	(0.60)
1997	561	(0.66)	2,428	(0.97)	204	(0.68)
2000	1054	(0.29)	645	(0.75)	49	(0.40)
2002	1251	(0.48)	1463	(0.65)	290	(0.67)

Aleutian Islands Surveys

	Rougheye		Shortraker		Northern	
1980	21,885		15,963		43,312	
1983	20,582		27,913		43,458	
1986	48,843		19,345		133,662	
1991	10,445	(0.48)	21,778	(0.69)	214,673	(0.16)
1994	13,344	(0.28)	26,230	(0.22)	92,433	(0.48)
1997	11,035	(0.22)	36,058	(0.27)	87,186	(0.31)
2000	14,205	(0.23)	37,136	(0.45)	205,300	(0.29)
2002	8361	(0.21)	15,382	(0.20)	175,950	(0.27)